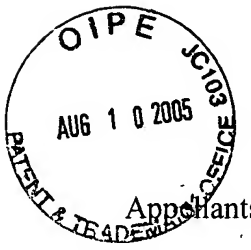
RGP-0088



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	Sethumadhavan et al.	)	
		)	Group Art Unit: 1775
Serial No.:	10/700,343	)	
		)	
Filed:	November 3, 2003	)	Examiner: Cathy Lam
		)	
For:	CIRCUIT SUBSTRATE MATERIAL, CIRCUITS COMPRISING THE SAME, AND METHOD OF MANUFACTURE THEREOF	)	

Assistant Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

08/11/2005 MWOLDGE1 00000063 061130 10700343
01 FC:1402 500.00 DA

I. REAL PARTY IN INTEREST

The real party in interest in this appeal is World Properties, Inc. Ownership by World Properties Inc. is established by assignment document recorded for this application on Reel/Frame 015390/0914.

II. RELATED APPEALS AND INTERFERENCES

There are no other related appeals or interferences known to Appellants, Appellants' legal representatives, or assignee that will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF THE CLAIMS

Claims 1-24 are pending in the application. Claim 20, previously withdrawn, is now canceled. Claims 1-19 and 21-24 stand finally rejected. The pending claims, as they currently stand, are set forth in Appendix A. Appellants hereby appeal the final rejection of Claims 1-19 and 21-24.

IV. STATUS OF THE AMENDMENTS

An Amendment After Final is being submitted with this Appeal Brief, correcting the dependency of claim 13 and canceling claim 20. The claims presented in the Appendix incorporate these Amendments.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The present claims are directed to polybutadiene and polyisoprene thermosetting circuit substrate materials for use in electrical circuit materials and the resulting products. These materials use magnesium hydroxide and a particulate fluoropolymer to achieve a desired flame retardancy without adversely affecting properties such as dielectric constant or moisture absorbance (Specification, page 3, lines 17-20). Prior polybutadiene and polyisoprene thermosetting materials have used halogenated, particularly brominated, flame retardant additives, which have recently come under scrutiny for environmental reasons. Commonly used alternative flame retardants such as phosphorous/nitrogen compounds possess high dielectric constants, loss factors, and moisture absorption properties. These properties are adverse to

intended uses in applications such as the electronic industries, automobile industries, and particularly in circuit boards and related applications (Specification, page 2, lines 19-21). Therefore, there is a need for non-halogen containing flame retardant thermosetting compositions having the desired flame retardant properties, but without impaired physical properties such as electrical and moisture absorption properties (Specification, page 2, lines 24-27). Surprisingly, use of a particulate fluoropolymer, together with about 20 to about 50 percent by weight of a magnesium hydroxide having a low ionic content, produces a thermosetting composition exhibiting excellent flame retardancy, electrical and moisture resistance properties (page 4, lines 15-19), thereby satisfying the need and the deficiencies of the prior art.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1-19 and 21-24 stand rejected under 35 U.S.C. § 103(a), as being unpatentable over U.S. Patent No. 5,972,811 to St. Lawrence et al., in view of U.S. Patent No. 6,528,559 to Nakacho et al., and U.S. Patent No. 5,416,143, to El Sayed et al.

VII. ARGUMENT

Claims 1-19 and 21-24 are Non-Obvious under 35 U.S.C. § 103(a) over St. Lawrence in view of Nakacho and El Sayed.

According to the Examiner, St. Lawrence discloses an electrical substrate material comprising a prepreg and a conductive layer such as a copper foil, wherein the prepreg is formed from polybutadiene and polyisoprene (Final Office Action dated March 9, 2005, p. 2). Other aspects of the claims are disclosed in St. Lawrence, including the fact that the prepreg further comprises a crosslinking agent, a filler, a curing agent, and a flame retardant (p. 3). The Examiner notes that the filler can be particulate polytetrafluoroethylene (p. 3), but that St. Lawrence is silent with respect to the use of magnesium hydroxide as a flame retardant (p. 3). St. Lawrence in fact describes only bromine-containing flame retardants, e.g., at column 2, lines 33-36; column 5, lines 14-15; and column 8, lines 23-29.

To remedy this deficiency, the Examiner cites Nakacho. The Examiner notes that Nakacho discloses a resin composition having a fire retardancy rating of V-0 measured in

accordance with UL-94 at column 2, lines 5-7 (Final Office Action, p. 3). Further according to the Examiner, "[T]he halogen free flame retardant can be magnesium hydroxide (col. 1 L 44-45)" (p. 3).

The Examiner also cites El-Sayed, which discloses a polyamide molding compound comprising a thermoplastic polyamide, a reinforcing material, inorganic fillers and an elastomer, and notes that the inorganic fillers are magnesium hydroxide particles incorporated into the polyamide resin (p. 4). The Examiner further cites column 2, lines 15-18 of El Sayed for the teaching that magnesium hydroxide particles are known to be used as a flame retardant (p. 4).

The Examiner concludes by stating that

> [I]n view of the prior art teachings, one [of] skill in the art would substitute magnesium hydroxide to be the flame retardant material because inorganic metal hydroxides do not reduce the molecular weight of the resin [and] thus improve mechanical properties and heat resistance of the resin, it also prevents dripping (Nakacho, col. 2 L 60-63 & col 9 L 19-27).

(Final Office Action, p. 4). With respect to the Applicants' prior arguments, the Examiner merely states that the arguments are against the references individually, and that one cannot show nonobviousness attacking references individually.

Applicants respectfully disagree, on the basis that the references considered *as a whole*, including any teaching away, do not render the present claims, *considered as a whole*, obvious.

The Examiner has relied on both Nakacho and El Sayed to provide the teaching missing from St. Lawrence, i.e., use of about 20 to about 50 wt. of magnesium hydroxide in a prepreg based on polybutadiene or isoprene. However, Nakacho as a whole teaches away from use of magnesium hydroxide. Nakacho cites magnesium hydroxide only in the "Background Art" section, as an example of a halogen-free flame retardant (col. 1, lines 43-44). Nakacho specifically teaches away from the use of inorganic metal hydroxides in the large amounts needed to provide a sufficient level of flame retardancy, as such "large amount addition entails a disadvantage that the inherent properties of synthetic resins (e.g., mechanical properties) are impaired" (col. 1, lines 55-58). Nakacho therefore advises the person of skill in the art to avoid the solution of the present claims, which require the use of magnesium hydroxide as a flame retardant at about 20 to about 50 percent by weight in a polybutadiene or polyisoprene resin system.

Indeed, Nakacho achieves the desired V-0 flame retardance rating using high molecular weight, crosslinked phenoxyphosphazene compounds (Abstract; col. 2, lines 55-57), not magnesium hydroxide. It is these high molecular weight crosslinked phenoxyphosphazene compounds that "do not reduce the molecular weight of the resin and thus [do] not impair the mechanical properties or heat resistance of the resin" (col. 2, lines 59-63). In the Examples of Nakacho, the weight average molecular weight of the crosslinked phosphazene compounds is 1030-1350 (Synthesis Examples 1-12). This is significantly more than magnesium hydroxide. Thus, the Examiner's alleged motivation to use a high molecular weight flame retardant does not apply to magnesium hydroxide.

The only teaching of Nakacho that could be said to apply to the present case is the suggestion that inorganic fillers can be used to enhance drip prevention (col. 9, lines 16-18). Nakacho does not disclose magnesium hydroxide fillers, but El Sayed does. El Sayed spherically discloses use of aminosilane-treated magnesium hydroxide, but only in polyamides (col. 3, 38-40). The disclosure that magnesium hydroxide is a known flame retardant is only directed to polyolefins and elastomers (col. 2, lines 15-17), not the present thermosetting resins. The question here is whether one of skill in the art, upon reading Nakacho and el Sayed *as a whole* would be motivated to combine the inorganic magnesium hydroxide fillers of El Sayed with the polybutadiene compositions of St. Lawrence, in view of the teachings of Nakacho that use of such fillers, in amounts sufficient to be effective, will degrade the mechanical properties of synthetic resins.

The answer is that in the field of electric circuit materials, one of ordinary skill would not ignore such a teaching. As pointed out in the specification of the present application, in electrical circuit materials it is important to use flame retardants that do not adversely affect the dielectric constants, loss factors, and moisture absorption properties of the substrates. These properties are adverse to intended uses in applications such as the electronic industries, automobile industries, and related applications (Specification, page 2, lines 19-21). For an obviousness rejection to be proper, the Examiner must meet the burden of establishing *prima facie* obviousness, including that the proposed modification of the prior art had a reasonable expectation of success, determined from the vantage point of the skilled artisan at the time the invention was made. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988). In this instance, there is no expectation of success in making the combination of St. Lawrence, Nakacho, and El

Sayed, as nothing in any of these references suggest that polybutadiene and polyisoprene circuit board materials may be successfully made flame retardant using magnsium hydroxide. Reversal of the rejection of the claims under 35 U.S.C. § 103(a) is therefore requested.

Assuming *arguendo* that the Examiner has presented a *prima facie* case (which the Appellants do not concede) it is believed that surprising, unexpected results are sufficient to overcome the rejection. Nothing within the knowledge of one skilled in the art or the cited prior art indicates that a polybutadiene or polyisoprene thermosetting composition, together with about 20 to about 50 percent by weight of a magnesium hydroxide having a low ionic content, produces an electrical circuit prepreg exhibiting excellent flame retardancy, electrical and moisture resistance properties. As Nakacho specifically teaches that use of amounts of inorganic hydroxides sufficient to confer flame retardancy lead to degraded mechanical properties, obtaining advantageous properties using magnesium hydroxide are surprisingly good results.

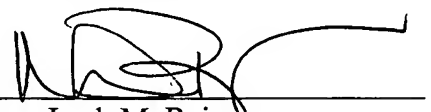
In summary, Claims 1-19 and 21-24 are non-obvious over the art of record for the reasons cited above. Appellants respectfully submit that all of the claims are allowable and the application is in condition for allowance. Appellants respectfully request reversal of the outstanding rejections and allowance of this application.

In the event the Examiner has any queries regarding the submitted arguments, the undersigned respectfully requests the courtesy of a telephone conference to discuss any matters in need of attention.

If there are any additional charges with respect to this Appeal, please charge them to Deposit Account No. 06-1130 maintained by Appellant's attorneys.

Respectfully submitted,

CANTOR COLBURN LLP

By 

Leah M. Reimer
Registration No. 39,341

Date:
CANTOR COLBURN LLP
55 Griffin Road South
Bloomfield, CT 06002
Telephone (860) 286-2929
Facsimile (860) 286-0115

VIII. PENDING CLAIMS ON APPEAL, WITH ENTRY OF AMENDMENT AFTER FINAL CO-FILED WITH THIS BRIEF

1. An electrical circuit material comprising a conductive layer disposed a substrate, wherein the substrate is formed from a thermosetting composition comprising:

a polybutadiene or polyisoprene resin;

a cross-linking agent;

a particulate fluoropolymer; and

about 20 to about 50 percent by weight, based on the total weight of the thermosetting composition, of a magnesium hydroxide having less than about 1000 ppm of ionic contaminants; wherein the substrate has a UL-94 rating of at least V-1.

2. The electrical circuit material of Claim 1, wherein the thermosetting composition further comprises a butadiene- or isoprene-containing copolymer.

3. The electrical circuit material of Claim 2, wherein the butadiene- or isoprene-containing copolymer is an unsaturated butadiene- or isoprene-containing copolymer.

4. The electrical circuit material of Claim 3, wherein the volume to volume ratio of the polybutadiene or polyisoprene resin to the unsaturated butadiene- or isoprene-containing copolymer is between 1:9 and 9:1, inclusive.

5. The electrical circuit material of Claim 1, wherein the thermosetting composition further comprises a curing agent.

6. The electrical circuit material of Claim 5, wherein the curing agent is an organic peroxide, a dicumyl peroxide, a di(2-tert-butylperoxyisopropyl) benzene, a t-butylperbenzoate, a t-butylperoxy hexyne-3, or a combination comprising one or more of the foregoing curing agents.

7. The electrical circuit material of Claim 1, wherein the thermosetting composition further comprises a low molecular weight polymer.

8. The electrical circuit material of Claim 1, wherein the thermosetting composition further comprises a functionalized liquid polybutadiene or polyisoprene resin.

9. The electrical circuit material of Claim 1, wherein the cross-linking agent is triallylisocyanurate, triallylcyanurate, diallyl phthalate, divinyl benzene, a multifunctional acrylate monomer, or a combination comprising one or more of the foregoing cross-linking agents.

10. The electrical circuit material of Claim 1, wherein the particulate fluoropolymer is a difluoroethylene polymer, a tetrafluoroethylene polymer, a tetrafluoroethylene-hexafluoropropylene copolymer, a copolymer of tetrafluoroethylene with fluorine-free ethylenic monomers, or a combination comprising one or more of the foregoing particulate fluoropolymers.

11. The electrical circuit material of Claim 1, wherein the substrate has a moisture absorption value less than about 0.2% and a UL-94 flammability rating of V-0.

12. The electrical circuit material of Claim 1, wherein the substrate has a dielectric constant less than about 4.5 and a dielectric loss factor less than about 0.01.

13. The electrical circuit material of Claim 1, wherein the conductive layer is copper.

14. The electrical circuit material of Claim 1, wherein the thermosetting composition further comprises a woven or non-woven glass web.

15. The electrical circuit material of Claim 1, wherein the magnesium hydroxide comprises less than about 500 ppm of metal.

16. The electrical circuit material of Claim 1, wherein the thermosetting composition further comprises a chlorine-containing flame retardant, a bromine-containing flame retardant, or a combination comprising one or more of the foregoing flame retardants.

17. The electrical circuit material of Claim 1, wherein the magnesium hydroxide has an average surface area of about 3 to about 12 meters squared per gram.

18. A circuit comprising the electrical circuit material of Claim 1.

19. A substrate for an electrical circuit material, wherein the substrate comprises a thermosetting composition comprising:

a polybutadiene or polyisoprene resin;

a cross-linking agent;

a particulate fluoropolymer; and

about 20 to about 50 percent by weight, based on the total weight of the thermosetting composition, of a magnesium hydroxide having less than about 1000 ppm of ionic contaminants; wherein the substrate has a UL-94 rating of at least V-1.

21. The electrical circuit material of Claim 1, wherein the magnesium hydroxide is coated with an aminosilane.

22. The electrical circuit material of Claim 1, further comprising a filler.

23. The electrical circuit material of Claim 22, where the filler further comprises a coupling agent.

24. The electrical circuit material of Claim 23, where the coupling agent is a silane.

IX. EVIDENCE APPENDIX

There is no evidence submitted pursuant to 37 C.F.R. § 130, 37 C.F.R. §131, or 37 C.F.R. § 132 or any other evidence entered by the Examiner and relied upon by the Appellant in this appeal, known to the Appellants, Appellants' legal representatives, or assignee.

X. RELATED PROCEEDING APPENDIX

There are no other related appeals or interferences known to Appellants, Appellants' legal representatives, or assignee that will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.